

**WEIGHTED-COVARIANCE FACTOR DECOMPOSITION OF VARMA MODELS APPLIED  
TO FORECASTING QUARTERLY U.S. GDP AT MONTHLY INTERVALS\***

Peter A. Zadrozny\*\*  
Bureau of Labor Statistics  
2 Massachusetts Ave., NE, Room 3105  
Washington, DC 20212  
e-mail: zadrozny.peter@bls.gov

Baoline Chen  
Bureau of Economic Analysis  
1441 L Street, NW  
Washington, DC 20230  
e-mail: baoline.chen@bea.gov

May 18, 2008

Key words: principal-components-type decomposition of time-series models

JEL codes: C33, C53

**ABSTRACT**

We develop and apply a method, called weighted-covariance factor decomposition (WCD), for reducing large estimated vector autoregressive moving-average (VARMA) data models of many "important" and "unimportant" variables to smaller VARMA-factor models of "important" variables and significant factors. WCD has four particularly notable features, compared to frequently used principal components decomposition, for developing parsimonious dynamic models: (1) WCD reduces larger VARMA-data models of "important" and "unimportant" variables to smaller VARMA-factor models of "important" variables, while still accounting for all significant covariances between "important" and "unimportant" variables; (2) WCD allows any mixture of stationary and nonstationary variables; (3) WCD produces factors, which can be used to estimate VARMA-factor models, but more directly reduces VARMA-data models to VARMA-factor models; and, (4) WCD leads to a model-based asymptotic statistical test for the number of significant factors. We illustrate WCD with U.S. monthly indicators (4 coincident, 10 leading) and quarterly real GDP. We estimate 4 monthly VARMA-data models of 5 and 11 variables, in log and percentage-growth form; we apply WCD to the 4 data models; we test each data model for the number of significant factors; we reduce each data model to a significant-factor model; and, we use the data and factor models to compute out-of-sample monthly GDP forecasts and evaluate their accuracy. The application's main conclusion is that WCD can reduce moderately large VARMA-data models of "important" GDP and up to 10 "unimportant" indicators to small univariate-ARMA-factor models of GDP which forecast GDP almost as accurately as the larger data models.

---

\*Earlier versions of the material here were presented at the Society for Computational Economics (Aix-en-Provence, June 2002, and Seattle, July 2003), the NSF-NBER Time Series Meeting (Philadelphia, September 2002), the Workshop on Forecasting Techniques of the European Central Bank (Frankfurt, December 2002), and the Econometric Society (Evanston, June 2003). The paper represents the authors' views and does not represent any official positions of the Bureau of Economic Analysis or the Bureau of Labor Statistics. We thank Ataman Ozyildirim for providing data from the Conference Board.

\*\*Affiliated as Research Fellow with the Center for Financial Studies (CFS), Goethe University, Frankfurt, Germany, and with the Center for Economic Studies and Ifo Institute for Economic Research (CESifo), Munich, Germany.